Critical Success Factors of Building Materials Availability at Construction Sites Using a Qualitative Approach

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Abstract

One of the most important elements in carrying out construction activities is the maintenance of the status of availability of construction materials at the construction site. If it fails to be prepared and maintained, the workers will not be able to perform their tasks. In fact, the motivation to perform a task will be lost and it will take a long time to return. Therefore, the objective of this paper is to identify the critical success factors of material availability at the construction site. A qualitative study in the form of interviews was conducted to thirty-eight construction contractors, including fifteen suppliers who met the selection criteria of this study. The results of the study revealed six critical success factors of material availability on the construction site. These factors include the contractor's current financial status; relationship (tolerance) between contractor and supplier; work planning and scheduling; good communication between main contractors and sub-contractors, and suppliers; availability of building materials in supplier's storage; and the availability of machines, machinery and trucks. All these critical success factors that have been obtained support the findings of previous studies in the context of the availability of materials at the construction site.

Keywords: *critical success factors, materials availability, construction sites, qualitative methods*

1. INTRODUCTION

One of the visions that have been created in Malaysia is the "Vision of Shared Prosperity 2030". It is a written and official national commitment that aims to continue Malaysia as a sustainable developing country with fair, equitable and inclusive economic distribution at all levels of income groups, ethnicities, regions and supply chains (Ministry of Economic Affairs, 2019). This commitment will continue to strengthen political stability and increase the country's prosperity and ensure that the people are united without prejudice. It can be achieved by celebrating the diversity of races and cultures as the basis of the unification of the nation and the country. To ensure that all these visions, aspirations and commitments are successfully achieved, the construction industry is once again given a great responsibility because of its ability to supply fixed capital to other industries in the country's economic landscape to continue to thrive in the future. Even the construction industry also depends on these industries to grow. This is because this industry requires the supply of production resources such as transportation, tourism, production, mining, and agriculture towards the effectiveness of its supply chain management. In addition, the construction industry is a major contributor to a more complete land transportation network system such as roads and highways, light and rapid mass transit, commuters, and monorails; including the provision of other construction related to civil engineering such as bridges, tunnels and dams. All these physical products produced are important to have a positive effect on the economic growth of a country as a whole. However, the interests of this industry are damaged due to dealing with the 3D syndrome which is 'Dirty', 'Dangerous', and 'Difficult' in the production process. In fact, this industry is often labeled as a backward industry because its implementation performance is static and does not change much from the previous original environment (Hanafi et al., 2018; Nannan et al., 2021). This situation has a significant impact on this industry to contribute greatly to the country's goals. The ability of the construction industry to be used to fulfill the wishes and aspirations of this government cannot be manipulated perfectly. One of the important efforts in ensuring the successful implementation of a construction project is to maintain the status of material availability at the construction site. The absence of materials at the construction site results in the workers not being able to carry out construction activities and it will

interfere with the smooth production of physical products expected from the operation at this construction site. The effect of failure to maintain materials on the construction site in domino theory is the employee's motivational status that is difficult to restore. This situation gets worse if this kind of environment occurs for a long period of time. In fact, the consequences of failure to provide these sources of supply are delays, low project performance, and the possibility of fines imposed on related contractors (Tam et al., 2021). Therefore, the objective of this paper is to identify the critical success factors of building material availability at construction sites. Therefore, the identification of these critical success factors will provide useful guidance to stakeholders towards improving the performance of construction projects. Next, it will be a noble effort to increase the competitiveness of the construction industry in a country as a whole.

2. CONSTRUCTION PROJECT PERFORMANCE AND THE BUILDING MATERIALS AVAILABILITY AT CONSTRUCTION SITES

A construction project involves an activity that is carried out repeatedly but in a different procurement environment, organization and locality from one construction site to another (Dubois and Gadde 2000). This temporary and long-term project is a small unit in the construction industry. Any success achieved in carrying out activities at the construction site will have a major impact on the effectiveness of the construction industry's service delivery to other industries in their respective supply chains in a country. On the other hand, if there is any failure in the implementation of the project in an effort to provide the physical product; then it will harm the construction industry itself and other industries as a whole. Characteristics of failure in the implementation of these construction projects include delays and incompleteness, cost overruns, poor quality, and accidents and deaths that occur on construction sites. Therefore, the cause of failure in the implementation of a construction project needs to be analyzed towards the effectiveness of its implementation. According to previous researchers (such as Abdul Kadir, et al., 2005; Ovararin, 2001; Park, 2002, Rojas and Aramvareekul, 2003; Kazaz and Acukera, 2015; Kazaz et al., 2016; Durdyevand Mbachu, Muhammad et al., 2015; and Gopal and Murali, 2015, Hanafi et al., 2010), factors related to the availability of construction materials greatly affect the performance and productivity of labor at the construction site. A study conducted by

Nasir et al. (2022) and Alagbari et al. (2019) also revealed that factors related to inappropriate building materials or prefabricated components are the second largest factors and have the most significant impact on labor productivity values in Malaysia and Yemen respectively.

The direct effect of the problem of the lack of building materials at the construction site is that workers are unable to carry out their activities as planned by the related contractor. Workers will be idle while waiting for construction materials to arrive at the construction site as planned at the initial stage. If this situation happens continuously, it will have a worse negative effect which is a motivation problem; the employee's tendency to carry out the planned activities becomes weaker which is referred to as demotivation. According to Ng et al. (2004), the problem of demotivation is difficult to recover in a short time and it becomes more difficult if the construction materials fail to be delivered to the construction site in a longer period of time. It takes time for their motivation to return to the level before the material supply failure occurred. In addition, the greater impact due to the failure to supply construction materials at the right time, quality, and quantity is the delay in completing the project, the project performance is low and finally, the reduction of profits occurs due to the imposition of non-completion fines on the contractors involved. One of the causes of construction project delays will occur if workers are unable to carry out construction activities due to material supply failure at the construction site (Sanni-Anibire et al., 2022). At the same time, the status of employees suffering from low motivation problems that failed to be restored in a short time also contributed to this failure. The performance of a project is often measured based on the ability of workers to carry out activities at the construction site (Tam et al., 2021). Besides that, Liquidated and ascertained damages are fines that will be imposed on the construction contractor involved if there is no good reason to present to the consultant the reasons for the delay. If employee motivation is high, then it will have a positive effect on project performance and the construction industry as a whole (Hamza et al., 2022).

Various studies have been carried out by previous researchers related to the factors that affect material management in a construction project (Jusoh and Kasim, 2017). A total of twenty-eight (28) studies have been carried out throughout the years 1994 to 2014 which have been published in various journals related to this

issue. It was found that a total of forty-seven (47) factors affect the effectiveness of materials management for construction projects as shown in Table 1. Eleven (11) factors have been identified as significantly influencing materials management in construction projects. The determination of this number is in line with the determination of the main factors that affect labor productivity on construction sites by Hanafi et al. (2010) and Abdul Kadir et al. (2005). In addition, the total frequency in previous studies has been mentioned in journals as the basis for determining these main factors including: -

Lack of Material Storage (Recorded frequency = 14)
Inadequate Planning (Recorded frequency = 11)
Poor Material Handling (Recorded frequency = 10)
Poor Delivery of Material to Sites (Recorded frequency = 9)
Restricted equipment movement at site (Recorded frequency = 9)
Poor quality of material (Recorded frequency = 8)
Improper material usage (Recorded frequency = 8)
Onsite transportation difficulty (Recorded frequency = 7)
Ordering Errors (Recorded frequency = 6)
Delays in material delivery (Recorded frequency = 6)
Material price fluctuation (Recorded frequency = 6)

It was found that the factors that have a direct relationship with the main and sub-contractors have a much greater frequency to the effectiveness of material management in a construction project. These factors include lack of material storage, inadequate planning, poor material handling, restricted equipment movement at site, poor quality of material, improper material usage, onsite transportation difficulty and ordering errors. While the factors that have a direct relationship with the supplier of building materials include lack of material storage, poor material handling, poor delivery of material to sites, poor quality of material and delays in material. Material price fluctuation is an external factor that affects the effectiveness of the material management; which is difficult to control by the main and sub-contractors, as well as suppliers. The effectiveness of materials management can be translated into an environment where materials are supplied at the right time and in sufficient quantity and quality to be used by workers on the construction site. Inefficient material management also has negative implications, namely the absence of materials on the construction site. This continuous environment will have a significant impact on the overall performance of a construction project. This situation becomes worse if there is a demotivating environment for the workers at the construction site.

3. RESEARCH METHODOLOGY

An interview approach was implemented with the parties involved. The details of the dependent variable, which is the status of availability, and independent variables, which are the factors that affect the availability of building materials at the construction site, can be obtained perfectly even though the sample size is small.

3.1. Sampling Design

A total of thirty-eight (38) respondents of various contractor registration statuses representing G1, G2, G3, G4, and G5 contractor registrations were involved in this study. The selection of this respondent is based on the majority of contractors throughout Malaysia belonging to this medium and small class. According to CIDB Malaysia (2015); and Kamal and Flanagan (2012), these small and medium business status contractors are the core of the Malaysian construction industry with a registration rate of ninety percent, while large business status contractors are as much as ten percent. The definition of small and medium construction businesses is as stated: a) G1- Is an enterprise with full-time employees of less than 5 or with annual sales turnover of less than RM200,000; G2 - G3 - Is an enterprise with full-time employees of between 5 and 19 or with an annual sales turnover between RM200,000 and less than RM 1 Million; and G4 - G5 - Is an enterprise with full-time employees of between 20 and 50 or with annual sales turnover of between RM 1 Million and RM 5 Million (CIDB Malaysia, 2015). In addition, a total of fifteen (15) building suppliers were also involved and both of the respondent's categories reached saturation of data collection. However, the respondents involved must meet the selection criteria set including (a) being directly involved in the management of ordering construction materials at the construction site; (b) having an academic qualification in the field related to construction; (c) having extensive experience, i.e. at least 10 years of work experience in the construction industry; and (d) collaborate in giving opinions independently related to the issue under study (Abdullah, 1999; Hanafi et al., 2018).

Table 1. Summary of identified influential factors affecting material management in construction projects

Influential factors	Previous Studies (*)																												Freq.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Shortage of fund		√				√									√							√				√			5
Improper material usage	√	√	√				√							√							√		√				√		8
Ordering errors			√											√			√		√		√		√						6
Excessive paperwork		√			√			√																			√		4
Delay in material procurement				√												√			√	√									4
Communication breakdown between main and site office																			√					√				√	3
Poor co-ordination between main and site office													√						√							√		√	4
Wastes due to negligence		√																				√					√		3
Inadequate qualified and experienced staff																√						√		√		√			4
Inefficient communication in construction sites															√				√										2
Unsystematic documentation						√																		√					2
Delay in forwarding information on sizes of materials to be used														√							√								2
Taking off error														√			√												2
Lack of material control														√															1
Lack of supervision														√															1
Poor quality of material	√		√				√				√		√			√		√								√			8
Material price fluctuation	√			√			√		√			√				√													6
Damages of material																				√	√		√						3
Shortage of material in market		√								√								√		√									4
Materials supplied in pallet			√											√															2
Fluctuating demand						√																		√					2
Improperly marked materials							√																						1
On-site transportation difficulties		√			√		√	√						√					√							√		7
Poor delivery of materials to site		√	√		√	√			√		√								√					√		√		9
Influential factors	Previous Studies (*)																												Freq.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
Damage during transportation			√										√	√															3
Inadequate planning	√	√					√	√						√	√	√					√		√	√			√		11
Poor material handling		√	√				√			√			√	√			√	√	√								√		10
Inefficient equipment for unloading			√			√							√	√															4
Lack protection during unloading													√	√															2
Unsystematic flow of material							√																						1
Restricted equipment movement at site			√	√			√		√					√	√						√	√						√	9
Congestion of site			√				√																						2
Lack of material storage	√	√	√	√				√	√	√					√			√	√		√		√				√	√	14
Inappropriate site storage													√	√			√		√										4
Improper storing methods														√															1
Materials stored for from working area														√															1
Delays in material delivery			√	√		√							√							√							√	6
Suppliers errors			√											√					√										3
Delay in manufacturing																				√		√			√				3
Lack of competent suppliers															√														1
Work stoppages at factories																								√					1
Monopoly by particular suppliers																								√					1
Wrong materials from specification			√				√														√		√	√					5
Ambiguous material specification	√																												1
Changes of material specification during construction				√			√													√									3
Delay in custom clearance for imported materials																								√					1
Lack of policy in procurement materials																											√		1

Note (*): 1- Nwachukwu and Emoh, 2010; 2 - Hughes and Thorpe, 2014; 3 - Nagapan, Abdul Rahman and Asmi, 2012;4 - Dolor, Sawhney, Iyer and Rentala, 2012; 5 - Rivas R.A., Borcherding, Gonz´alez and Alarcón, 2010; 6 - Abdul Rahman and Alidrisyi, 1994; 7 - Kazaz, Manisali, and Ulubeyli,

2008; 8 - Kaming, Olomolaiye, Holt and Harris, 1997; 9 - Jarkas and Bitar, 2011; 10 - Patil and Pataskar, 2013; 11 - Potty, Irdus and Ramanathan, 2011; 12 - Durdyev and Mbachu, 2011; 13 - Wan and Kumaraswamy, 2009; 14 - Osmani, Glass and Price, 2008; 15 - Toor and Ogunlana, 2008; 16 - Sambasivan and Soon, 2007; 17 - Tam, Shen, Fung and Wang, 2007; 18 - Enshassi, Mohamed, Abu Mustafa and Mayer, 2007; 19 - Navon and Berkovich, 2005; 20 - Assaf and Al-Hejji, 2006; 21 - Osmani, Glass and Price, 2006; 22 - Abdul Kadir, Lee, Jaafar, Sapuan and Ali, 2005; 23 - Ekanayake and Ofori, 2004; 24 - Manavazhi and Adhikari, 2002; 25 - Odeh and Battaineh, 2002; 26 - Makulsawatudom and Emsley, 2001; 27 - Zakeri, Olomolaiye, Holt and Harris, 1996; 28 - Ogunlana, Promkuntong and Jearkjirm, 1996

Source: Mat Jusoh and Kasim (2017)

3.2. Data Collection Procedure

In order to achieve all the questions of this study, a structured interview approach was conducted where various questions were asked to the study respondents. One of the influencing factors and elements of the success of the availability of construction materials at the construction site determined by the respondents of the study is then explained in this interview session. It has given a comprehensive overview of its importance in achieving the status of availability of building materials at the construction site. All the knowledge, experience and views of the respondents in determining the factors that influence the effectiveness of the implementation of the procedure are recorded to prevent this valuable data from being dropped. Similarly, the elements of success to achieve the goal are also recorded perfectly to be used in the next stages of the methodological procedure of the study. Interviews with respondents were conducted from February to July 2022 with each session taking 40 to 60 minutes. Earlier, an appointment with the respondents involved was made at least two weeks before the interview session was held as the platform, location and time were agreed upon before that. A reminder to hold an interview session with the respondent was done 1 to 2 days before that. This is because they have a busy work schedule to complete the projects they handle. A total of 15 interview sessions were conducted at the construction site, and 11 and 15 sessions were held at the contractors' respective company and suppliers' hardware offices respectively. While the remaining 4 and 8 interview sessions respectively used the telephone platform and virtual meetings through the Zoom and Google Meet applications. In the face-to-face interview session either at the construction site or at the respondent company's office, compliance with the Standard Operating Procedure to break the chain of Covid19 that has been outlined by the Malaysian government at that time. Compliance with this government directive is necessary because the spread of Covid19 was still happening at that time. Interviews with the respondents of this study were mostly conducted in Bahasa Malaysia. A small part is more likely to use English. The use of language, whether Bahasa Malaysia or English, is subject to the comfort and desire of the study respondents.

3.3. Data Analysis

A qualitative study using a structured interview approach requires a specific analysis towards concluding the various data collected. For

that purpose, Richie and Spencer (1994) who have developed a 5-level data analysis approach based on qualitative research referred to and used it in this study. This 5-stage data analysis approach based on qualitative research is as follows: -

3.3.1. Familiarization

All raw qualitative data was recorded in the questionnaire and then transferred and converted into data transcriptions. Systematic and thorough data transfer and conversion are highly demanded at this stage. This is because the accuracy of data analysis at the next stages is dependent on the accuracy of data handling at this stage. Transfer and conversion errors are easy to occur at this stage because it is the basic data collected directly from the study respondents. To ensure the high validity of these data transcriptions, multiple references have been made to the recording material used during the interview session.

3.3.2. Identifying a thematic framework

According to Ritchie and Spencer (1994), the theme framework developed from the qualitative raw data involved ``a logical and intuitive thought process... and then making appropriate judgments about the underlying meaning, importance and relationship with the issues highlighted and the relationship between ideas and other ideas wisely'. A detailed observation of qualitative raw data is done to form themes and identify logical relationships holistically towards describing a phenomenon observed. It is a search process to ensure that all the created questions are answered perfectly by the respondents of this study. The main interview questions are related to the implementation procedures of construction works influenced by certain factors. Therefore, this thematic framework involves the expansion of these two questions namely factors affecting the availability of materials and its impact called available or not available of materials at the construction sites. The majority of study respondents are more inclined to delegate the factors that affect the availability of building materials at the construction site to three (3) main groups, namely: (1) Contractor Organizations; (2) Supplier Organizations; and (3) Outside and Environment The framework that includes these three (3) main groups was created based on the feedback from the study respondents regarding the factors that affect the availability of building materials at the construction site. In addition, two (2) dimensions of the availability of building materials at the construction site have been successfully

identified, namely: (1) Available; and (2) Not Available.

3.3.3. Indexing

The thematic framework that has been identified through the process of preparing interview transcripts and then through the process of interpretation using numbered codes with the help of NVivo 2.0 qualitative analysis software. Coding of the indices was done using relevant key statements. It was done by the research respondents during the interview session. Each major theme identified is associated with an explanatory statement that illuminates and justifies the formation of a thematic framework. This explanatory statement is collected from several similar statements made by the respondents based on the same basic theme.

3.3.4. Charting

At this stage, a theme-based data visualization process is identified. This was done through the process of citing similar themes generated from the transcription of the interviews (Ritchie and Spencer 1994). Data was displayed through the use of charts based on two main approaches, namely (a) thematic framework, and (b) research determination. This main element has a common theme which then crosses all the respondents of the study or a group of respondents across all related themes (Ritchie and Spencer 1994). A macro and comprehensive view or analysis of the feedback on each theme from the relevant respondents can be done perfectly. However, there are situations where feedback on each theme developed is not communicated by the study respondents. The existence of a theme can still be accepted if the statement is supported by the majority of the study respondents.

3.3.5. Mapping and interpretation

Qualitative data analysis is driven by 6 main steps including a) concept identification; b) mapping range and nature of phenomena; c) topological production; d) unity search; e) production of information; and f) related strategy development (Ritchie and Spencer, 1994). The analysis of this study is done on the questions that have been formed in the early stages of this study. Mapping analysis is based on data themes that have been collected before the evidence structure is produced. The data that has been collected has revealed the factors that affect the availability of building materials at the construction site. These factors need to be considered in such a project environment to ensure the successful supply of construction materials at the construction site.

4. RESULTS

Six (6) critical success factors have been successfully identified using a qualitative approach in this study. The research response has responded effectively to the questions that have been raised towards concluding six critical success factors in ensuring the availability of materials at the construction site as stated below:

4.1. The current financial status of the contractor

In order to produce the final product and the necessary building components, the developer needs a stable financial status of the contractor towards the effectiveness of the supply of materials needed in a construction project. This is because the supplier will only supply building materials to contractors who have a strong financial status. It is very necessary especially in an environment where the contractor still has little to do with a supplier company. The building materials involved in a construction project are expensive. Therefore, the contractor's financial ability to pay for all the construction materials at the promised time is important for the related suppliers. When the supplier is confident of the contractor's ability to pay for all the construction materials ordered, the supplier will supply the construction materials immediately. The supplier will deliver the building materials in the expected time, quality and quantity to ensure a good relationship can be established with this contractor. If the supplier fails to secure the contractor's payment assurance for the construction materials ordered; then the supplier may not act promptly to meet the contractor's request because there is doubt about getting the proper payment. As a result, the construction materials ordered were not delivered as expected by the contractor involved; ultimately have a negative impact on the availability status of materials at the construction site.

4.2. Good relationship (tolerance) between contractor and supplier

A good relationship until there is tolerance between the two parties, i.e., contractors and related suppliers is listed as a critical success factor in the availability of building materials in a construction site. This good relationship can be achieved if both parties, the contractor and the supplier, trust each other and trust each other in conducting their business affairs. A relationship of mutual trust and confidence in each other can be formed and nurtured for the survival of their respective businesses. When there is a good relationship between them, the implementation of activities related to the supply of materials at the

construction site becomes easier and more effective. As an implication of the good relationship between these two parties, an attitude of tolerance was born in the hearts of contractors and suppliers involved. The attitude born between these two parties will facilitate the supply of construction materials sent to the construction site because both parties enjoy working together. This attitude of tolerance is important to embody between the two parties in order to face the increasingly complex and uncontrolled project implementation environment. The closer the relationship is established with the point of compromise perfectly existing between these two parties, the more clearly the availability of building materials at the construction site can be realized in the real environment.

4.3. Work planning and scheduling

Perfect and holistic work planning and scheduling must be prepared by the contractor before starting the implementation is also listed as a critical success factor in ensuring the availability of materials at the construction site. At the initial stage, the management should determine the need for effective and perfect building materials to be used on the construction site. Any failure in providing good and effective work planning and scheduling will cause the building materials that will be used at the time, quality and quantity set to be unable to be supplied by the suppliers involved perfectly. Contractors need to list and order building materials according to the priority and sequence of implementation of a construction project. With this order list based on work planning and scheduling action plans, suppliers can perfectly prepare all building materials on the construction site. The construction material order form becomes effective when reference is made to the contractor's planning action plan and work schedule. A holistic work planning and scheduling action plan will guide all activities related to the ordering of building materials more perfectly on the construction site.

4.4. Good communication among main contractors, subcontractors and suppliers

The relationship that exists between one party and another party in carrying out activities related to construction is communication. Communication is a form of signal or information sent from the sender to the receiver through a certain medium. Good and effective communication occurs if the recipient receives complete information from the informant; the time factor is also involved for this communication. Therefore, this factor of good and effective communication needs to exist

between the main contractor and the subcontractors and suppliers involved. It is to ensure the availability of building materials at the construction site is realized in the real environment. Any failure of a party to convey that information to another party will have a significant impact on the availability of building materials at the construction site. Therefore, all parties should join hands to ensure that this effectiveness is fully achieved in the construction project. Next, have a significant impact on the entire implementation of a construction project.

4.5. Availability of building materials in the suppliers' storage

This critical success factor of availability is very sensitive to the current status of building materials in the supplier's storage or control. These building materials must be ensured to be sufficient in terms of quantity and quality towards the effectiveness of their delivery at the construction site. If there is a current situation where it is not in storage and control but the party is willing to provide it; therefore, it will invite the risk of the availability of building materials at the construction site to the contractor. The contractor needs to make sure that the supplier can supply the building materials. This capability refers to whether it exists in the current storage or there is clear evidence of the existence of control of the building materials by the supplier involved.

4.6. Availability of machine, machinery and trucks

Building materials are related to a large quantity, heavy and large size. It requires the help of machines, machinery and trucks to move it from the storage location to the construction site. The machines, machinery and trucks used by the supplier are obtained through rental activities or own ownership. This situation may cause damage or failure to the machines, machinery and trucks; preventing to operate perfectly in the activities of ordering, transporting and unloading building materials in a construction project. The high dependence on the status of the presence and perfection of these machines, machinery and trucks causes this factor to be considered critically towards success in fulfilling the status of availability of building materials at this construction site. This situation exists because although the building materials are in the storage or control of the supplier, the status of the machines, machinery and trucks is also important to emphasize. Any damage or failure of the assisted operation of these machines, machinery and trucks will harm the level of availability of building materials at the construction site.

5. DISCUSSIONS

A comparison between the factors that affecting the effectiveness of material management and the findings of this study has been properly done in this paper. It was found that six (6) critical success factors from the findings of this study have supported the findings of previous studies in the same context. Poor material handling and the problem delivery of material to sites faced by the supplier are caused by the current financial status of the contractor and the relationship or nature of tolerance that exists between the contractor and the supplier in the material procurement of a construction project. If the financial status of the contractor involved causes less tolerance between the two parties, the supplier becomes less confident in dealing with the contractor. If this situation exists, it can be caused delays in material delivery to the construction site. All the most important factors except the factors related to material price fluctuations affecting the effectiveness of material management, were also expressed as critical success factors of work planning and scheduling and communication among main contractors, subcontractors and suppliers in this study based on a qualitative approach. All factors that have been synthesized in previous studies are contained in these two (2) critical success factors. While factors related to inadequate planning and poor material handling are included in the critical success factor related to the availability of building materials in the supplier's storage. If good planning cannot be produced and material handling cannot be done perfectly, it will result in the materials being difficult to provide by the supplier for use in a construction project. In addition, if good planning fails to be established, the handling of materials is not able to be carried out perfectly and there are problems of material delivery to the construction site, improper material usage, difficulty in movement and transportation in the construction site area and finally the delay in the delivery of construction materials has actually been represented by critical success factors related to the absence of machines, machinery and trucks. This is because all these factors can occur due to the unavailability of machines, machinery and trucks at the construction site. Factors related to fluctuations in the price of construction materials have been clearly stated to greatly influence the effectiveness of materials management in construction projects in previous studies. However, it was not listed as a critical success factor in the findings of this qualitative study. This

situation exists because the fluctuating environment of the price of building materials in the market is difficult to directly control by the main contractors, sub-contractors and suppliers involved in a construction project. It is one of the external factors that are controlled by the elements of supply and demand in the free or control market. It includes the control of using fiscal and monetary policies by the government of a country involved. Table 2 shows a comparison of the findings of this study against previous studies in the context of the availability of materials at the construction site.

Table 2. Comparison of the factors influencing the availability of materials at the construction site: Research findings versus Existing knowledge

No	Research Findings	Existing Knowledge
1	Current financial status of the contractor	Poor material handling Poor delivery of material to sites Delays in material delivery
2	Relationship (tolerance) between contractor and supplier	Poor material handling Poor delivery of material to sites Delays in material delivery
3	Work planning and scheduling	Lack of material storage Inadequate planning Poor material handling Poor delivery of material to sites Restricted equipment movement at site Poor quality of material Improper material usage Onsite transportation difficulty Ordering errors Delays in material delivery
4	Communication among main and sub-contractor; and supplier	Lack of material storage Inadequate planning Poor material handling Poor delivery of material to sites Restricted equipment movement at site Poor quality of material Improper material usage Onsite transportation difficulty Ordering errors Delays in material delivery
5	Availability of building materials in the suppliers' storage	Inadequate planning Poor material handling
6	Availability of machine, machinery and trucks	Inadequate planning Poor material handling Poor delivery of material to sites Improper material usage Onsite transportation difficulty Delays in material delivery
7	-	Material price fluctuation

6. CONCLUSION

The tendency of critical success factors to meet the status of availability of building materials at the construction site is happening in the main contractor organization including subcontractors and suppliers. The contractor needs to be stable in the context of financial status if they have just made order and supply arrangements with certain suppliers. At the same time, the contractor needs to increase the intimacy of the relationship with the suppliers involved so that an attitude of tolerance is fostered between them. The closeness between them is important for creating a feeling of mutual need, respect, and help until perfection in the supply of building materials at the construction site is triggered. At the same time, the contractor needs to focus on producing a good and realistic planning and scheduling action plan. It is important to translate this action plan into a more organized and systematic order list of building materials needed on the construction site. Good and effective communication between the main contractor and subcontractors and suppliers should always be implemented. This is because the sufficiency of information conveyed from one party to the other within the time frame involved will have a significant impact on the successful supply of building materials at the construction site. The supplier also plays an important role in ensuring that the availability of building materials can be realized at the construction site. These building materials must always exist in the storage or control of the supplier. This is because any failure to ensure this environment exists will harm the availability status of building materials at the construction site. In addition, the supplier also needs to ensure that all machines, machinery or lorries that are rented or owned are always in perfect condition. It is important to be given serious attention by the supplier to ensure the effectiveness of the activities of transporting and unloading the building materials involved. Next, it will indirectly affect the status of the availability of building materials at the construction site. The main contractors, sub-contractors and suppliers need to work hand in hand to ensure the availability status of building materials can be realized at the construction site. Relationships and communion are good until the feeling of need-need, help-help and respect need to be nurtured from time to time towards the effectiveness of unloading and placing building materials on the construction site. Contractors and suppliers must ensure that all information and production resources involved are handled and maintained

perfectly. This situation is necessary because all the information and production resources involved are always available to be used for that purpose. Therefore, these six factors are critical to be considered to ensure the completeness of the supply of building materials can be realized at the construction site.

The quantitative-based findings that have been done in previous studies and the qualitative-based findings in this study are consistent. Therefore, the project management needs to ensure that all the main factors that affect the availability of construction materials at the construction site are taken into account in the planning, implementation and control process. It is important to be implemented by the project management because it can be used as a basis to ensure the effectiveness of the implementation of a construction project. In turn, it will have a significant impact on the growth of the country as a whole.

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